DESCRIPTION OF APHANTOPHRYNE, A NEW BATRACHIAN GENUS FROM NEW GUINEA;

With Comparative Notes on the Pectoral Musculature.

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(Plates liv.-lv.)

The material on which the present paper is based consists of a collection of six small frogs belonging to a single species. They were collected in 1896 by the late A. Giulianetti, at an altitude of 12,200 feet on Mount Scratchley, in the Owen Stanley Range, British New Guinea. While they undoubtedly belong to the family Brevicipitidæ* (Engystomatidæ *auct.*), I cannot find a definition of any genus with which they agree even approximately. Therefore, a new genus has been characterised, for which the name *Aphantophryne* is proposed.

The most interesting feature about this new form is the apparent absence of a sternal plate. At first, thinking that my dissection of a small, poorly preserved specimen was at fault, I regarded the absence of this important element with reserve. However, after a careful examination of three specimens, I have failed to find it, and, as will be seen later, the modification of the pectoral musculature certainly points to its total reduction.

There are twenty-six genera of Brevicipitidæ recognised from India, Malay, East Indies, Papuasia, and Australia, sixteen of which have a highly specialised sternal apparatus, modified by the loss of the procoracoid cartilage and clavicles. As *Aphantophryne* also lacks these elements, its affinities must be sought amongst this group of genera.

* I have followed Stejneger (Proc. Biol. Soc. Wash., xxiii., 1910, p. 165), who shows that, as the name of the type-genus of the family Engystomatidæ, namely *Engystoma*, is untenable, Cope's name Brevicipitidæ must replace it.

I am unable, however, to place it definitely. The absence of a sternal plate separates it from all members of the Brevicipitidæ, with the exception of the African *Hemisus*, in which genus, the clavicles and omosternum are well developed. If we put aside consideration of the remarkable sternal apparatus, and turn our attention to other characters used to differentiate genera, its affinities appear to be equally divided between *Hylophorbus* Macleay,* (*Mantophryne* Blgr. et auct.), and *Metopostira* Méhely. Its relationships are best shown by the following table.

Table showing the chief generic characters of the Indo-Malayan, East Indian, and Papuasian genera of Brevicipitidæ, in which the clavicles and procoracoid cartilages are absent.

	Palate toothed.	Palate toothless.	Palate ridged.	Tympanum hidden.	Number of œsophageal ridges.	Tongue entire.	Pupil.	Toes free.	Fingers disked (or swollen).	Toes disked (or swollen).	Terminal phalanges.	Sternal plate absent.
Aphantophryne Fry ...	.	×	.	.	2	×	–	×	.	.	T	×
Hylophorbus Macleay..	.	×	.	.	2	×	–	×	×	×	T	.
Cnathophryne Méhely.	.	×	×	.	2	×	–	×	×	×	T	.
Xenorhina Peters ...	×	×	.	.	1	×	–	×	.	×	T	.
Metopostira Méhely ...	.	×	.	.	2	×	–	×	×	×	T	.
Copiula Méhely ...	.	×	×	.	1	×	–	×	×	×	T	.
Copiula(?) Wandolleck†	.	×	.	.	1	×	–	×	×	×	T	.
Phrynixalus Böttger ...	.	×	×	.	1	×	–	×	×	×	T	.
Pomatops Barbour ...	.	×	.	×	2	×	0	×	×	×	T	.
Cophixalus Böttger ...	.	×	×	×	1	×	–	.	×	×	T	.
Phrynella Boulenger ...	.	×	.	×	?	×	–	.	×	×	T	.
*Gastrophryne*Fitzinger‡	.	×	×	×	1	×	1	×	×	×	1	,
Microhyla Tschudi ...	.	×	×	×	1	×	1	.	×	×	1	.
Kaloula Gray ...	.	×	×	×	2	×	1	?	×	×	1&T	.
Callulops Boulenger ...	×	.	×	.	1	×	1	×	×	×	1	.
Phrynomantis Peters ...	.	×	×	×	0	.	1	×	×	×	T	.
Xenobatrachus P. & D.	×	.	.	.	?	.	?	×	×	×	?	.

* *See* Fry, Mem. Q'land Mus., ii., 1913, p.48.

† Wandolleck, Abh. v. Ber. d. k. Zool. u. Anthr.-Eth. Mus. zu Dresden, xiii., 1910, p.11.

‡ Stejneger, Proc. Biol. Soc. Wash., xxiii., 1910, p.165. It is here shown that *Gastrophryne* Fitzinger, 1843, must replace *Engystoma* Fitzinger, 1828, as the latter genus is based on *Rana oralis* Schn., which was also the type of Merrem's genus *Breviceps*, of 1820.

APHANTOPHRYNE,* gen.nov.

Pupil horizontal, oval. Tongue oval, entire, free behind and slightly on the sides. Palate toothless, not ridged. Two transverse folds in front of the œsophagus; the anterior small and sometimes not papillose, the posterior situated between the eustachian tubes, and strongly papillose. Choanæ moderately large, oval. Tympanum slightly visible. Skin smooth. Fingers and toes free; they are flattened, but not enlarged or disked at the tips. Outer metatarsals separated by a groove. Terminal phalanges T-shaped.

Clavicles, procoracoid cartilage, omosternum, and sternum absent. A thin ligament extends from the scapula to the symphysis, where it is produced a little. Coracoids very strong and expanded at the symphysis. The cartilage (epicoracoid) is produced slightly and rounded posteriorly, and may represent a degenerate sternal plate, but no such plate is present as a separate element.

Type, *A. pansa* Fry.

Relationships doubtful, but showing affinity to *Metopostira* Méhely, and *Hylophorbus* Macleay.

APHANTOPHRYNE PANSA,† sp.nov.

(Plates liv.; lv., fig.2.)

Habit robust. Head very broad, triangular; its length two-thirds($\frac{2}{3}$) its width at the level of the tympana. Snout rounded, slightly prominent, as long as or slightly shorter than the diameter of the orbit. Nostril much nearer the tip of the snout than the eye. Canthus rostralis feebly marked, rounded; loreal region shelving, slightly concave. Interorbital space broader than the upper eyelid. Tympanum slightly visible, covered by skin, about one-half the diameter of the eye. Lower jaw trilobed, and but very slightly truncate. Tongue large, oval, entire, and free for about one-half its length posteriorly, and a little on the

* Meaning "obscure toad." This name may be taken as having reference to both its affinities and habitat.

† "Broad-footed."

sides. Choanæ placed well forward, with a groove entering anteriorly from the side. Palatine ridges not present.* Two dermal ridges in front of the œsophagus; the anterior is sometimes not papillose, being represented by a median dermal lobe, the posterior long and always papillose. Arms rather weak. Fingers subcylindrical or depressed, not fringed or disked, the first a little shorter than the second. Hind limb stout. Foot broad. Toes moderate or rather short, subcylindrical or depressed, not fringed or disked. A weak indication of an inner metatarsal tubercle, otherwise the palmar and plantar surfaces are smooth. The length of the outstretched hindlimb, from the anus to the tibio-tarsal articulation, equals the distance from the anus to the axilla. Skin perfectly smooth.

Colour (in spirits) uniform dark brown above. Lower surfaces also uniform dark brown, or creamy-white, variously clouded and speckled with dark brown (Pl. liv., fig. 2). Anterior part of forearm sometimes yellowish. Lower eyelid white.

Total length of type from snout to vent, 27 mm.

Loc.—Six specimens, from Mount Scratchley, on the Owen Stanley Range, British New Guinea, at an altitude of 12,200ft. Collected by the late A. Giulianetti in September and October, 1896. The largest specimen, figured on Plate liv., fig. 1, has been chosen as the type.

Type in the Australian Museum, Sydney.

The ligament mentioned in the above diagnosis of the genus *Aphantophryne* is made clear by reference to the Plates. The question must necessarily arise as to whether this ligament represents a stage in the process of the degeneration of the procoracoid cartilage. If we trace the reduction of clavicles and procoracoids through the many phases exhibited by the recent genera, several facts in turn become evident.

i. As the clavicle weakens (as, say, in *Chaperina*) the proco-

* The palatine bones are seen, through the transparency of the integument of the palate, to meet in the middle line, and form a slight expansion. This is shown in fig. 1*b* on Plate liv., and is also the case in *Metopostira* and *Hylophorbus*.

racoid appears to strengthen, being, no doubt, influenced by the tendency to counterbalance, liable to occur in any evolutionary process.

ii. A further reduction of the clavicle marks the cessation of the increase in the procoracoid.

iii. As the clavicle becomes almost totally reduced (as exhibited by the genus *Sphenophryne*), and the bone can no longer be said adequately to perform its original function in the girdle, the procoracoid, which cannot replace it in supplying the necessary support and muscle-attachment, also weakens. At this stage we can notice—(*a*) a reduction in the size and arrangement of the pectoral muscles; (*b*) a correlated reduction in the size and strength of the arms; (*c*) a marked strengthening and expansion of the coracoids at the symphysis; and sometimes (*d*) an increase in the size and strength of the sternal plate.

(iv.) A further stage is shown by the genus *Microbatrachus* Roux, in which the clavicles appear to be quite absent, and the procoracoid a weak, tape-like cartilage extending from the scapula to the symphysis.

v. Finally, we have the complete reduction of the clavicular and procoracoidal elements shown in *Kaloula*, *Hylophorbus*, etc.

It will be seen, then, that the ligament of *Aphantophryne* occupies an analogous position to the procoracoid of *Microbatrachus*, but, for the following reasons, we cannot regard them as homologous. There is no reason to doubt that the tape-like band of the latter is a true cartilaginous procoracoid of a degenerate nature, but, in *Aphantophryne*, it is a tough, translucent, fascia-like band, which, from a macroscopical examination, I have no hesitation in pronouncing a true ligament. Then, too, in some species of *Sphenophryne*, the reduced procoracoid has lost its connection with the scapula, but its free distal end is joined to the shoulder by a true, ligamentous band. This would appear to be the homologue of the ligament in question. In fact, if we imagine the final reduction of the procoracoid to take place along this line, we should then have a decreasing cartilage, with an increasing band of ligament, which, in the end, would

connect with the symphysis. Such a band would have an analagous position to the ligament anterior to the coracoid in *Aphantophryne*, and it is reasonable to presume that it was along such lines that the remarkable ligament of this new genus evolved.

Notes on the Pectoral Myology of Aphantophryne pansa compared with that of Limnodynastes dorsalis and Kaloula pulchra.

The interesting nature of the pectoral muscles of *Aphantophryne pansa*, revealed by the dissection to examine the sternal apparatus of the type-specimen, has led me to prepare the following notes.

It would have been more satisfactory to have reserved any anatomical investigation till more suitably preserved material came to hand, but the variation of the breast-muscles is of such an unusual nature, and is so directly related to the most interesting taxonomic feature of this new form, namely, the absence of a sternal plate, that any notice, however superficial, will, I think, be of present interest. It is hoped that the poor condition of my material has led to but few serious errors.

The pectoral musculature of several members of the family Brevicipitidæ (Engystomatidæ *auct.*) has been dealt with by Dr. F. E. Beddard, in a series of papers published in the Proceedings of the Zoological Society of London. I must acknowledge the great assistance I have received from these fine papers, and have gleaned from them the main points of accord and discord, and intercalated them briefly below.

For comparative purposes, two hitherto unfigured frogs are illustrated, and briefly described. One, *Limnodynastes dorsalis* var. *dumerilii* Peters,* belonging to the family Cystignathidæ, has a complete arciferous pectoral girdle. The other, *Kaloula pulchra* Gray,† belonging to the same family as *Aphantophryne*, and systematically not far removed from it, has a firmisternal girdle with no clavicles or omosternum, but differs from it in

* Fry, Rec. Austr. Mus., x., 1913, p.26, Pl. iii., fig.2.

† Boulenger, Cat. Batr. Brit. Mus., 1882, p.167, figs.

possessing a large, sternal plate. Although the first of these two frogs is much more widely separated from *Aphantophryne* than are a number of Brevicipitid frogs available for dissection, it is of interest, comparatively, since it shows more clearly the modification of the muscles correlated with the reduction of the pectoral girdle. This is the primary object of these notes.

In addition to the muscular variations due to the widely different sterna of the three species under discussion, a considerable divergence is noticed between them as regards the comparative development, and respective size of the muscles. This is mainly due to the greater or lesser development of the fore-limbs, which are largest in *L. dorsalis*.

One of the most striking differences between *L. dorsalis* and *A. pansa*, indeed, between the latter and any other Batrachian that I know of, lies in the condition of the *rectus abdominalis* muscle. In *Limnodynastes dorsalis* (Plate lv., fig.3, *ra.*), it is essentially the same as in *Rana esculenta*,* but differs somewhat from that of *Kalonla pulchra* (Plate lv., fig.1, *ra.*) owing to the absence of a linea alba in the latter. On removing the ventral skin of these frogs, it is plainly visible covering the large space between the inner edges of the pectorales abdominis. In *A. pansa*, however, the rectus abdominalis is not visible without the aid of further dissection.

When the abdominal portion of the pectoral and the two obliques (to be described later) have been removed, the remarkable, paired condition of the rectus is revealed (Plate lv., fig.2,*ra.*). Posteriorly, they are fairly broad, and in contact in the middle line; but, anteriorly, they are narrow and quite separate medially. There is, of course, no trace of a *linea alba*, and, as far as I can be sure, there is only one, very obscure *inscriptio tendinea*, situated at about the point where the pectorales abdominis meet medially. Beneath the coracoids (as viewed from the ventral side) they unite with the muscle which I take to be the sterno-hyoideus of each side. Towards the hinder part of the body,

* Hoffmann, Bronn's Klass. Thier-Reichs, Bd. vi., Abth., 2, 1873-78, Taf. xvii., *pt.*

they lie immediately beneath the obliquus muscles; but, anteriorly, they are more deeply situated. In *Rana temporaria*,* there are five poststernal *inscriptiones tendineæ*; while in *L. dorsalis* (Plate lv., fig.3, *it.*) and *Rhinoderma darwini*,† there are only four; *Megalophrys nasuta*,‡ *Xenophrys monticola*,§ and *Kaloula pulchra* have three; and *Hemisus guttatum*‖ but two; while, in *Breviceps*,¶ there is, as I suppose in *Aphantophryne*, only one.

The whole, superficial, abdominal surface of *A. pansa* is covered by two muscles. As before mentioned, the rectus abdominalis is completely hidden by these. By far the greater extent is overlain by the two, large pectorales abdominis, but a V-shaped area remains between the anterior borders and the posterior edges of the pectorales sternales. This is covered by an extremely fine, transparent muscle, whose fibres run almost parallel to those of the pectorales sternales, at an angle of about 70° to the longitudinal axis. This muscle, which is obvious on the sides of the body as well, is no doubt a true *obliquus externus*. In the median ventral line, the muscles of each side are separated, although the tough fascia appears to bridge the gap, through which may distinctly be seen the heart and conus (Plate lv., fig.2, *c.* and *v.*). Bordering this median gap, the obliquus externus is replaced by a band of longitudinal fibres (Plate lv., fig.2, *oel.*) which I had at first thought to be a distinct muscle, but which I have been quite unable to separate from it. These fibres seem to be wrapped in the same fascia as the obliquus, and to connect anteriorly with the expanded, symphysial portion of the coracoids. The different angle of the fibres is certainly conducive to regarding them as a distinct muscle, but, till better preserved material is available, this point cannot be settled.

Beneath the external oblique muscle is a layer of even more obscure fibres, which are so delicate and transparent that they

* Beddard, Proc. Zool. Soc., 1907, p.338.
† Beddard, *loc. cit.*, 1908, p.683.
‡ Beddard. *loc. cit.*, 1907, p.338.
§ Beddard, *loc. cit.*, 1907, p.882.
‖ Beddard, *loc. cit.*, 1908, p.903.
¶ Beddard, *loc. cit.*, 1908, p.683.

can only be seen by carefully angled lighting. These fibres, representing the *obliquus internus* (Plate lv., fig.2, *oi.*), run almost at right angles to those of the more superficial muscle; that is, they run outwards and backwards from the middle line of the ventral surface. They are so extremely thin that I cannot trace their boundaries or attachments, but they appear to underlie those of the more superficial muscle *in toto*.

The *pectorales abdominis* of *A. pansa* (Plate lv., fig.2, *pa.*) are very large, and in other respects unusual. From their origin at the posterior extremity of the body, they run forward, covering superficially almost the whole abdominal surface. For the greater part of their length, they are in contact medially, but, a short distance behind the symphysis of the coracoids, they diverge, and, narrowing rapidly, enter their insertion beneath the deltoid muscle. In *L. dorsalis* (Plate lv., fig.3, *pa.*) and *K. pulchra* (Plate lv., fig. 1, *pa.*) their insertion is also overlain by the deltoid; while, in *Hemisus guttatum** and *Xenophrys monticola*,† they disappear beneath the pars sternalis of the pectoral. The fibres of the pectoralis abdominis run obliquely in the anterior portion of the muscle, but posteriorly are almost longitudinal. The muscle is characteristically thin, and separates readily from the underlying obliquus externus.

In *L. dorsalis* and in *K. pulchra*, the pectoralis abdominalis presents some peculiarities worthy of notice. In both these species, a remarkable modification of much the same nature occurs, which, as well as being exceptional in itself, is all the more noteworthy because of its presence in two such widely separated frogs. Thus, we find the muscle in each case divided into two distinct portions, which I have here called the portio internus (Plate lv., figs. 1 and 3, *pai.*) and the portio externus (*pae.*) relative to their respective positions.

The *portio internus* of the *pectoralis abdominis* (Plate lv., fig.3, *pai.*) in *L. dorsalis* is fan-shaped, the fibres radiating from the narrow insertion to the line of origin on the first two poststernal segments of the rectus abdominalis. The line of origin is oblique

* Beddard, Proc. Zool. Soc., 1908, p.899, fig.176.

† Beddard, *loc. cit.*, 1907, p.882, fig.231.

and nearly straight. Starting from the posterior margin of the sternal plate some little distance from the linea alba, it runs outwards and backwards at an angle of about 45°, crossing the first and anterior two-thirds of the second segment of the rectus. The *portio externus* (*pae.*) of the muscle is long and strap-like, and lies just external to, and touching the edge of the portio internus along its whole length. It extends along the length of the abdomen, is of equal width throughout, and enters its insertion beneath the deltoid together with the inner portion. It appears to be bound in the same fascia as the portio internus, from which, however, it is easily separated.

In *K. pulchra*, the *portio internus* (Plate lv., fig.1, *pai.*) is also fan-shaped, but with this, the similarity between the pectorales of the two forms ends Two peculiarities of the inner portion are of a most unusual nature. Firstly, the most anterior fibres, *i.e.*, those nearest the pars sternalis, overlap that muscle, and to a great extent hide it from view, finding attachment on the median line of the sternal plate, inside the origin of the fibres of the pars sternalis, which do not meet those of the muscle of the opposite side. Secondly, the portion of the pectoralis abdominis, which attaches to the sternum, is in contact with its fellow along the middle line of the breast-plate. This peculiar arrangement is made clear by the figure in Plate lv., in which the greater part of the right pectoralis is shown dissected away. The abdominal line of origin of the pectoralis abdominis is curved, and terminates postero-laterally on the first inscriptio tendinea. The *portio externus* (Plate lv., fig.1, *pae.*), although quite distinct from the inner portion, is connected to it and to the integument by multitudinous fibres, which seem to arise from the fascia investing the muscle. It is triangular in shape, thus differing from the condition in *L. dorsalis*, and is somewhat longer than the inner portion. The inner edge of the portio externus overlaps the outer edge of the inner portion to a considerable extent, as the pins in the figure indicate (Plate lv., fig.1). When seen from the ventral aspect, the triangular nature of the outer portion is not evident, as only the innermost edge is visible, the greater portion of the muscle lying on the side of the body.

The division into *pars sternalis* and *pars epicoracoidalis* of the pectoralis is very obscure in *A. pansa*. Along the line of origin on the symphysis, there is no trace whatever of any differentiation of the fibres; but, distally, as they approach their insertion beneath the detoid and pars abdominalis, a slight separation into a small anterior and a larger posterior moiety is noticeable. The anterior portion, representing the *pars epicoracoidalis* (Plate lv., fig.2, *pe.*) of other frogs, finds attachment on the anterior portion of the epicoracoid cartilage and the median expansion of the ligament (Plate liv,, fig.1g, *lig.*) which lies in the position of an omosternum. The posterior moiety, or the *pars sternalis* (Plate lv., fig.2, *psp.*) arises wholly from the epicoracoid and its weak posterior extension. It will be evident that these fibres, designated as the pars sternalis, in all probability represent the portio anterior of that muscle, as found in other frogs.

This seems to exclude whatever room for doubt there exists as to whether the sternal plate will be found in *Aphantophryne* as a separate element. In those frogs which possess a distinct sternum, we find the pars sternalis invariably attaching to it. If the sternum is cartilaginous, as in *L. dorsalis*, then the muscular attachment is of a lesser extent than in the case of such frogs as *Rana* and *Megalophrys*, in which the sternum has a strong, calcified style. In *Aphantophryne*, however, we find the most posterior fibres of the pectoralis sternalis attaching to the weak, posterior extension of the epicoracoid cartilage, making the necessity of provision for further attachment, in the form of a sternal plate, seem quite superfluous.

In *L. dorsalis*, in which there is a complete pectoral girdle, with omosternum and sternal plate, and much more powerful limbs, the arrangement is naturally very different. It shows three distinct divisions lying one in front of the other. The anterior or *pars epicoracoidalis* (Plate lv., fig.3, *pe.*) is very like that of *Rana esculenta.** Its fibres do not attach to the omosternum. The median portion represents the *portio anterior* of

* Hoffmann, Bronn's Klass. Thier-Reichs, Band iv., 1873-78, p.134, Taf. xvii., *pe.*

the *pectoralis sternalis* (*psa.*), and arises from the epicoracoidal arc, but is separated from its fellow in the middle line. The *portio posterior* (*psp.*) arises on the anterior half of the sternum and from the ligament binding the overlapping epicoracoids. It hides from view the coraco-brachialis brevis interior, and the coraco-brachialis longus, as the pars epicoracoidalis also hides the coraco-radialis.

In *K. pulchra*, the arrangement is much the same as in *L. dorsalis*, with the exception of a few details of origin, insertion, and relative position The *pars epicoracoidalis* (Plate lv., fig.1, *pe.*) is hardly distinguishable from the pars sternalis. The median division, or *po tio anterior m. pectoralis sternalis* (Plate lv., fig.1, *psa.*) is even less distinct than in *L. dorsalis*. The most posterior fibres of this muscle attach to the sternum, but the others arise along the epicoracoid, as also do those of the pars epicoracoidalis. The *portio posterior*(*psp.*) is relatively weak, and its fibres originate wholly from the sternum. As before mentioned, it is almost hidden from view by the portio internus m. pectoralis abdominalis Its fibres arise a little to one side of the middle line, showing those of the pectoralis abdominalis of each side to be in contact along their line of origin.

I have been unable to find a *coraco-radialis*, like that of *Rana esculenta*, in *A. pansa*. In *L. dorsalis*, there is a muscle, which I take to be the *coraco-radialis proprius* of Hoffmann* (Plate lv., fig.3, *pr.*). It underlies the pars epicoracoidalis and portio anterior of the pectoralis sternalis, and, by those muscles, is hidden completely from view, as is mentioned by Dr. Beddard† in the case of *Megalophrys nasuta*. It arises on the epicoracoid arc, and its fibres have much the same angle as those of the more superficial pectoralis. In *K. pulchra*, there is an obscure band of muscle (Plate lv., fig.1, *pn.*) which is analogous to the coraco-radialis of *L. dorsalis*. As in that species, it is hidden from view by the pars epicoracoidalis, and partly also by the anterior portion of the pars sternalis. In *Metopostira ocellata*, a frog

* Hoffmann, *loc. cit.*, p.135, Taf. xvii., *crp.*

† Beddard, *loc. cit.*, 1907, p.337.

which possesses undoubted affinities to *A. pansa*, Professor von Méhely* has figured the coraco-radialis as plainly discernible in front of the pars epicoracoidalis.

The *pectoralis cutaneus* is absent in all three frogs under discussion. In *K. pulchra*, as in *Hemisus guttatum*, *Xenophrys monticola*, and *Megalophrys nasuta*, the septum dividing the thoracic and abdominal lymph-spaces is distinct, but is not invaded by muscle-fibres.

In *L. dorsalis*, there is a well-developed *coraco-brachialis longus* (Plate lv., fig.3, *cbl.*). In front of this is a *coraco-brachialis brevis internus* (*cbb.*) which, although not so large as the first-mentioned muscle, is nevertheless stronger than the same muscle in *R. esculenta*.† Both these muscles are hidden by the pectoralis sternalis.

I am doubtful whether the muscle homologised with the *coraco-humeralis* in *A. pansa* and *K. pulchra* is correctly so called. In the former, its fibres border the distal half of the coracoid posteriorly, attaching to that edge of the bone; in the latter, however, the muscle arises from the whole length of the coracoid, and a few fibres seem to originate on the sternal plate. This last condition is almost the same as in *R. esculenta*, and although *A. pansa* differs somewhat from it, *K. pulchra* seems to exhibit no features which supply grounds for doubting its identity. In this last species also, a slight indication of a separation of the fibres into a more anterior band is noticeable; these probably represent a coraco-brachialis brevis internus. However, my material is so poorly preserved, that I am unable to come to any definite conclusion at present.

The *deltoid* (Plate lv., fig.2, *dl.*) of *A. pansa* is weak and tape-like. A *pars episternalis* is wanting. The same muscle in *K. pulchra* (Plate lv., fig.1, *dl.*) is much stronger and broader, but is otherwise identical. In *L. dorsalis*, there is a distinct *pars episternalis* (Plate lv., fig.3, *dle.*) the fibres of which originate on the omosternum. The *portio scapularis* is overlain by the mylohyoideus.

* V. Méhely, Termés. Füzetek., xxiv., 1901, vii., fig.6, *cr.*

† Hoffmann, *loc. cit.*, Taf. xvii., figs.6-8, *cbbi.*

The most important features of the pectoral myology of the three frogs may be briefly referred to as follows :—

Aphantophryne pansa Fry.

(1). The *pectorales abdominis* are very large, and, meeting in the middle line a short distance behind the pectoral girdle, they obscure nearly all the other ventral muscles from view. They originate at the posterior extremity of the body.

(2). The *obliquus externus* is separated on the median, ventral line, and is on a more superficial plane than the rectus abdominis. A band of medially-placed fibres, which run parallel to the longitudinal axis of the body, may or may not be part of this muscle.

(3). The *pectoralis sternalis* is much reduced, and the division into *pars epicoracoidalis* and *pars sternalis* is obscure.

(4). A *coraco-radialis*, like that in *Rana esculenta*, is absent.

(5). A *pectoralis cutaneus* is absent.

(6). A *coraco-humeralis* (*coraco-brachialis longus* ?) seems to be present, although some doubt exists as to whether this muscle is correctly identified (see text).

(7). A *coraco-brachialis brevis internus* is not present as a separate muscle.

(8). The *deltoid* is weak and strap-like. There is no *pars episternalis*, and the *pars scapularis* is rendered rather prominent by the reduction in size of the pectoralis.

(9). The *rectus abdominis* is hidden from view by the large pectorales abdominis. On dissection, it is seen to be in two separate bands, which are widely separated in the middle line anteriorly. There is no *linea alba*, and only one(?) poststernal *inscriptio tendinea*.

Kaloula pulchra Gray.

(1.) The *pectoralis abdominis* is divided into two portions. The *portio internus* is fan-shaped, and arises from the first poststernal segment of the rectus; its anterior fibres are in contact with those of the other side, and attach to the sternal plate. The *portio externus* is quite distinct from the inner portion, and is triangular in shape; its inner edge overlaps the outer edge of the latter. There are numerous fibrous connections with the integument.

(1). The obliquus muscles, internus and externus, show nothing extraordinary.

(3). The *pectoralis sternalis* is well-developed. The *pars epicoracoidalis* is normal; the *pars sternalis* is divisible into two portions, an anterior and a posterior. The *portio posterior* does not meet its fellow, being separated in the median line by the attachment of the portio internus of the pectoralis abdominis. Its fibres originate wholly from the sternum.

(4). A *coraco-radialis* is present.

(5). A *pectoralis cutaneus* is absent, but the septum dividing the pectoral and abdominal lymph-spaces is well-marked, though not invaded by fibres.

(6). A *coraco-humeralis* (*coraco-brachialis longus* ?) is present.

(7). A *coraco-brachialis brevis internus* is perhaps represented, as the fibres of the last-mentioned muscle(6) show an indication of a division into an anterior bundle.

(8). The *deltoid* is strong, and has no *pars episternalis.*

(9). The *rectus abdominis* is well-developed, and resembles that of *Megalophrys nasuta* and *Xenophrys monticola* in having only three, poststernal *inscriptiones tendineæ.* There is no *linea alba* present.

LIMNODYNASTES DORSALIS var. DUMERILII Ptrs.

(1). The *pectoralis abdominis* is divided into two portions, the *portio internus* which is fan-shaped, and the *portio externus* which is long and strap-like. The first arises on the two, anterior, poststernal segments of the rectus; and the latter from the posterior extremity of the ventral surface. The two pectorales are separated in the median line, and the rectus is plainly visible.

(2). The *obliquus externus* and *internus* are normal.

(3). The *pectoralis sternalis* is strongly developed. It is plainly divisible into a *pars epicoracoidalis*, and a *pars sternalis*; the latter is in two divisions, an anterior medially situated, and a posterior, whose fibres arise from both the sternal plate and the ligament binding the overlapping epicoracoids.

(4). A *coraco-radialis* is well developed.

(5). The *pectoralis cutaneus* is absent.

(6). A *coraco-brachialis longus* is normally developed.

(7). A *coraco-brachialis brevis internus* is rather strongly developed.

(8). The *deltoid* is strong, and a *pars episternalis* connects with the omosternum. The *portio scapularis* is overlain by the mylohyoideus.

(9). The *rectus abdominis* is normal. A *linea alba* is present, and there are four poststernal *inscriptiones tendineæ*.

EXPLANATION OF PLATES LIV.-LV.

Plate liv.

Aphantophryne pansa Fry.

Fig. 1.—Dorsal view of the type-specimen.

Fig. 1*a*.—Side-view of head.

Fig. 1*b*.—View of palate.

Fig. 1*c*.—Dorsal view of terminal phalanx of fourth toe.

Fig. 1*d*.—Lateral view of terminal phalanx of fourth toe.

Fig. 1*e*.—Ventral view of hand.

Fig. 1*f*.—Ventral view of foot.

Fig. 1*g*.—Sternal apparatus of type-specimen; *lig.*, ligament.

Fig. 2.—Ventral view of a very stout specimen.

(All the figures enlarged.)

Plate lv.

Fig. 1.—*Kaloula pulchra* Gray; ventral view of breast, the skin and pectoral muscles of the right side dissected away.

Fig. 2.—*Aphantophryne pansa* Fry; ventral view of breast, the skin and pectoral muscles of the right side dissected away.

Fig. 3.—*Limnodynastes dorsalis* Gray, var. *dumerilii* Peters; ventral view of body, the skin and pectoral muscles of the right side dissected away.

REFERENCES.

c., conus arteriosus of the heart—*cbb.*, coraco-brachialis brevis internus—*cbl.*, coraco-brachialis longus—*ch.*, coraco-humeralis—*cl.*, clavicle—*cor.*, coracoid—*dl.*, deltoid—*dle.*, pars episternalis deltoidei—*ec.*, epicoracoid cartilage—*it.*, inscriptio tendinea (first poststernal)—*la.*, linea alba—*lg.*, ligament—*mh.*, mylohyoideus—*oe.*, obliquus externus—*oel.*, median longitudinal fibres connected with obliquus externus—*oi.*, obliquus internus—*os.*, omosternum—*pa.*, pectoralis abdominalis—*pae.*, portio externus m. pectoralis abdominalis—*pai.*, portio internus m. pectoralis abdominalis—*pe.*, pars epicoracoidalis m. pectoralis—*pr.*, coraco-radialis (or sterno-radialis)—*psa.*, portio anterior m. pectoralis sternalis—*psp.*, portio posterior m. pectoralis sternalis (Fig. 3)—*psp.*, pectoralis sternalis (Fig. 2)—*ra.*, rectus abdominalis—*sh.*, sternohyoideus—*st.*, sternum—*v.*, ventricle of heart.